REMARKS

Reconsideration of the above-identified application is respectfully requested. Claims 1-19 remain in the application. The specification has been amended to correct typographical errors. Attached hereto is a marked-up version of the changes made to the specification by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

I. Rejection under 35 U.S.C. § 103(a): Joyce Jr. in view of Roberts

Claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,292,559 to Joyce Jr. et al. in view of U.S. Patent No. 3,787,210 to Roberts. Specifically, the Examiner asserted that it would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to provide a coating that comprises a mixture of the transfer material to be deposited and a matrix material, wherein the matrix material has the property of being or becoming more volatile than the transfer material when exposed to laser energy in order to utilize the combustible characteristics of the matrix material in a coating thereby obtaining higher resolution at increased speeds and at a reduced laser requirement.

Applicants respectfully submit that claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 are not obvious over Joyce Jr. in view of Roberts. A prima facie case of obviousness requires the Examiner to provide, inter alia, "some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). See

also *In re Wilder*, 166 U.S.P.Q. 545, 548 (C.C.P.A. 1970); *In re Rinehart*, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976); *In re Fritch*, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992).

A reference that teaches away from the claimed invention undermines its value as prior art in an obviousness rejection. See generally *In re Sponnoble*, 405 F.2d 578, 587 (C.C.P.A. 1969); *In re Caldwell*, 319 F.2d 254, 256 (C.C.P.A. 1963). A reference teaches away "when a person of ordinary skill, upon reading the reference, could be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

The process described by Joyce Jr. involves heterogeneous layers and uses the high energy of the ablated species to cause intermixing at the interface. Joyce Jr. teaches that high energy densities are required to achieve good adhesion and imaging. (Col. 5, lines 37-39) Specifically, Joyce Jr. teaches that the energy density range is 8 J/cm^2 to 20 J/cm^2, preferably 12 J/cm^2 to 18 J/cm^2. (Col. 5, lines 41-44) Thus Joyce Jr. teaches away from using low energy densities, especially energy densities below 12 J/cm^2.

The present invention uses a homogeneous composite instead of heterogeneous layers and a soft transfer process in which adhesion is caused, in part, by covalent chemical bonding at a well-defined and unperturbed interface. The materials used in the present invention are more fragile than those used in Joyce Jr. and need lower energy densities. The energy density used by Joyce Jr. would cause irreversible damage to the materials of the present invention. Energy densities for the present invention range from 0.05 J/cm^2 to 10 J/cm^2, and are typically 0.1 J/cm^2 to 2 J/cm^2. (Page 19, line 9). Since Joyce Jr. teaches away from using energy densities this low, it does not render obvious the subject matter of the present invention.

Moreover, it is well settled that obviousness cannot be established by combining the teachings of the prior art, absent some teaching, suggestion, or incentive supporting the combination. *In re Geiger*, 2 U.S.P.Q.2d 1276 (Fed. Cir. 1987); *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 U.S.P.Q. 929 (Fed. Cir. 1984). "It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." *In re Fritch*, 972 F.2d 1260, 1266, 23 U.S.P.Q.2d 1780, 1784 (Fed. Cir. 1992). "[O]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Joyce Jr. discloses a non-contact transfer of metal from a target having a coating that is a multilayer composite. An objective of Joyce Jr. is to produce a smooth continuous deposited layer with good adhesion. Roberts discloses contact transfer and is primarily concerned about visible contrast. There is nothing in Joyce Jr. or Roberts that suggests using a mixture of the transfer material to be deposited and a matrix material in a non-contact transfer process. In fact, Joyce Jr. suggests against it because "a unique multi-layered composite" is one factor for the "superior adhesion" obtained in its process. (Col. 2, lines 1-4) Thus, the Examiner has not established a prima facie case of obviousness.

Moreover, there must be evidence that the combination would have made the claimed invention obvious to one of ordinary skill in the art. Joyce Jr. uses the method of laser-induced forward transfer, which is different from the present invention and has several disadvantages as described on page 3, lines 12-20 and page 4, lines 1-8 of the specification:

> Because the film material is vaporized by the action of the laser, laser induced forward transfer is inherently a homogeneous, pyrolytic technique and typically

> cannot be used to deposit complex crystalline, multi-component materials or materials that have a crystallization temperature well above room temperature because the resulting deposited material will be a weakly adherent amorphous coating. Moreover, because the material to be transferred is vaporized, it becomes more reactive and can more easily become degraded, oxidized or contaminated. The method is not well suited for the transfer or organic materials, since many organic materials are fragile and thermally labile and can be irreversibly damaged during deposition. Moreover, functional groups on an organic polymer can be irreversibly damaged by direct exposure to laser energy. Other disadvantages of the laser induced forward transfer technique include poor uniformity, morphology, adhesion, and resolution. Further, because of the high temperatures involved in the process, there is a danger of ablation or sputtering of the support, which can cause the incorporation of impurities in the material that is deposited on the receiving substrate. Another disadvantage of laser induced forward transfer is that it typically requires that the coating of the material to be transferred be a thin coating, generally less than 1 μm thick. Because of this requirement, it is very time-consuming to transfer more than very small amounts of material.

Roberts does not overcome these differences or disadvantages. Therefore, the combination of Joyce Jr. and Roberts does not render obvious the subject matter of the present invention.

II. <u>Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Itoh</u>

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 4,702,958 to Itoh et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the particle size of the transfer material. Therefore, the Examiner supplemented Joyce Jr. and Roberts with the Itoh transfer material having grain sizes between 10nm and 20μm. Itoh does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Itoh does not render obvious the subject matter of claims 3 and 4.

III. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Blanchet-Fincher

Claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 5,288,528 to Blanchet-Fincher. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the use of a polymer as the transfer material. Therefore, the Examiner supplemented Joyce Jr. and Roberts with the Blanchet-Fincher polymer transfer material. Blanchet-Fincher does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Blanchet-Fincher does not render obvious the subject matter of claim 6.

IV. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Kodas

Claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 6,165,247 to Kodas et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the use of a transfer material which comprises metal of ceramic particles coated with an organic precursor. Therefore, the Examiner supplemented Joyce Jr. and Roberts with Kodas's use of metal particles used to form a thin film being coated with an organic precursor. Kodas does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Kodas does not render obvious the subject matter of claim 7.

V. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Williams

Claims 10 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 4,987,006 to Williams et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the use of an addition polymer as a matrix material. Therefore, the Examiner supplemented Joyce Jr. and Roberts with Williams's use of addition polymers as a matrix material. Williams does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Williams does not render obvious the subject matter of claims 10 and 11.

VI. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Williams (II)

Claim 13 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 5,135,870 to Williams (II) et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the use of a matrix material selected from the group which includes water, aryl solvents, arene solvents, halogenated organic solvents, hydrocarbons, ketones, esters, ethers, carboxylic acids, phenols and phosphoric acid. Therefore, the Examiner supplemented Joyce Jr. and Roberts with the Williams (II) matrix material. Williams (II) does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Williams (II) does not render obvious the subject matter of claim 13.

VII. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Isomi

Claim 16 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 5,401,616 to Isomi et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose the application of the transfer/matrix mixture by a coating method selected from the group consisting of spin coating, ink jet deposition, jet vapor deposition, spin spray coating, aerosol spray deposition, electrophoretic deposition, pulsed laser deposition, matrix assisted pulsed laser evaporation, thermal evaporation, sol gel deposition, chemical vapor deposition, sedimentation and screen printing. Therefore, the Examiner supplemented Joyce Jr. and Roberts with the Isomi coating application method. Isomi does not make up for the inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Isomi does not render obvious the subject matter of claim 16.

VIII. Rejection under 35 U.S.C. § 103(a): Joyce Jr. and Roberts in view of Tatah

Claim 19 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Joyce Jr. et al. and Roberts as applied to claims 1, 2, 5, 8-9, 12, 14-15 and 17-18 above, and further in view of U.S. Patent No. 5,814,165 to Tatah et al. The Examiner noted that the combination of Joyce Jr. and Roberts does not disclose means to position the source of the pulsed laser with respect to the receiving substrate whereby the receiving substrate can be pretreated or whereby a transfer material deposited on the substrate can be annealed or etched. Therefore, the Examiner supplemented Joyce Jr. and Roberts with the Tatah means to position the source of the pulsed laser energy with respected to the receiving substrate. Tatah does not make up for the

inadequacies of Joyce Jr. and Roberts discussed above and, therefore, the hypothetical combination of Joyce Jr., Roberts and Tatah does not render obvious the subject matter of claim 19.

In view of the foregoing, it is respectfully submitted that this application is ready for allowance. Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account No. 50-0281.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

The paragraph beginning at page 2, line 19 has been amended as follows:

In the direct writing technique known as "laser induced forward transfer" (LIFT), a pulsed laser beam is directed through a laser-transparent target substrate to strike a film of material coated on the opposite side of the target substrate. The laser vaporizes the film material as it absorbs the laser radiation and, due to the transfer of momentum, the material is removed from the target substrate and is redeposited on a receiving substrate that is placed in proximity to the target substrate. Laser induced forward transfer is typically used to transfer opaque thin films, typically metals, from a pre-coated laser transparent support, typically glass, SiO_2, Al_2O_3, $SrTiO_3$, etc., to the receiving substrate. Various methods of laser-induced forward transfer are described in, for example, the following U.S. patents and publications incorporated herein by reference: U.S. Patent No. 4,752,455 to Mayer, U.S. Patent No. 4, 895,735 to Cook, U.S. Patent No. 5, 725,706 to Thoma et al., U.S. Patent No. 5,292,559 to Joyce Jr. et al., U.S. Patent No. 5,492,861 to Opower, U.S. Patent No. 5,725,914 to Opower, U.S. Patent No. 5,736,464 to Opower, U.S. Patent No. 4,970,196 to Kim et al., U.S. Patent No. 5,173,441 to Yu et al., and Bohandy et al., "Metal Deposition from a Supported Metal Film Using an Excimer Laser, J. Appl. Phys. 60 (4) 15 August 1986, pp 1538-1539. Because the film material is vaporized by the action of the laser, laser induced forward transfer is inherently a homogeneous, pyrolytic technique and typically cannot be used to deposit complex crystalline, multi-component materials or materials that have a crystallization temperature well above room temperature because the resulting deposited material will be a weakly adherent amorphous coating. Moreover, because the material to be

transferred is vaporized, it becomes more reactive and can more easily become degraded, oxidized or contaminated. The method is not well suited for the transfer of organic materials, since many organic materials are fragile and thermally labile and can be irreversibly damaged during deposition. Moreover, functional groups on an organic polymer can be irreversibly damaged by direct exposure to laser energy. Other disadvantages of the laser induced forward transfer technique include poor uniformity, morphology, adhesion, and resolution. Further, because of the high temperatures involved in the process, there is a danger of ablation or sputtering of the support, which can cause the incorporation of impurities in the material that is deposited on the receiving substrate. Another disadvantage of laser induced forward transfer is that it typically requires that the coating of the material to be transferred be a thin coating, generally less [that] <u>than</u> 1 μm thick. Because of this requirement, it is very time-consuming to transfer more than very small amounts of material.

The paragraph beginning at page 5, line 2 has been amended as follows:

Therefore, there is a strong need for devices and methods for transferring materials for uses such as in electronic devices, sensing devices or passivation coatings [with] in such a way that desired properties of the materials are preserved or enhanced. For example, there is a need for a method to transfer powders or particulate materials so that they retain their bulk properties. With respect to novel materials such as organic polymers that are incorporated into electronic devices, there is a need for a method to transfer these materials in such a way that their structural and chemical integrity is retained.

The paragraph beginning at page 5, line 20 has been amended as follows:

It is a further object of the present invention to provide a device [ad] and method for depositing a material on a substrate by laser induced deposition wherein the spatial resolution of the deposited material can be as small as 1 μm.

The paragraph beginning at page 6, line 3 has been amended as follows:

It is an object of the present invention to provide equipment and a method for creating an electronic device, sensor, or passivation coating by depositing a [materials] material on a substrate in a controlled manner wherein the process can be computer-controlled.

The paragraph beginning at page 6, line 6 has been amended as follows:

It is an object of the present invention to provide equipment and a method for creating an electronic device, sensor or passivation coating by depositing a [materials] material on a substrate in a controlled manner wherein it is possible to switch rapidly between different materials to be deposited on the substrate.

The paragraph beginning at page 16, line 9 has been amended as follows:

Specific polymeric matrix materials include, but are not limited to, the following: polyacrylic acid –butyl ester, nitrocellulose, poly(methacrylic acid)-methyl ester (PMMA), poly(methacrylic acid)-n butyl ester (PBMA), poly(methacrylic acid)-t butyl ester (PtBMA), polytetrafluoroethylene (PTFE), polyperfluoropropylene, poly N-vinyl carbazole, poly(methyl isopropenyl ketone), poly alphamethyl styrene, polyacrylic acid, [alpha phenyl, methyl ester,]

polyvinylacetate, polyvinylacetate with zincbromide present, poly(oxymethylene), phenol-formaldehyde positive photoresist resins and photobleachable aromatic dyes.

The paragraph beginning at page 21, line 20 has been amended as follows:

The apparatus of the present invention can also be adapted so that an entire pattern of transfer material is deposited simultaneously on a patterned substrate.